

CLAIMS:

1. Magnetic particles capable of binding a target substance, which comprise a magnetic material and a matrix material, wherein the magnetic material is remanent upon exposure to a magnetic field and the matrix material has a surface comprising functional groups which promote disaggregation of the particles in the presence of a liquid phase.
2. Magnetic particles according to claim 1, wherein the magnetic material comprises a magnetic metal oxide.
3. Magnetic particles according to claim 2, wherein the magnetic metal oxide comprises an iron oxide in which, optionally, all or a part of the ferrous iron thereof is substituted by a divalent transition metal selected from cadmium, chromium, cobalt, copper, magnesium, manganese, nickel, vanadium, and/or zinc.
4. Magnetic particles according to any of claims 1 to 3, wherein the magnetic material comprises a ferrimagnetic material.
5. Magnetic particles according to claim 4, wherein the ferrimagnetic metal oxide comprises ferrimagnetic magnetite.
6. Magnetic particles according to any of claims 1 to 3, wherein the magnetic material comprises a ferromagnetic material.

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7. Magnetic particles according to any preceding claim, the length or diameter of which is in the range 0.1 to 5000 μ m.
8. Magnetic particles according to any preceding claim, which are substantially spherical.
9. Magnetic particles according to any preceding claim, wherein the matrix material comprises a polymer.
10. Magnetic particles according to claim 9, wherein the polymer comprises an organic polymer or a silica-based polymer.
11. Magnetic particles according to any preceding claim wherein the functional groups of the matrix material are hydrophilic for use with an aqueous liquid phase.
12. Magnetic particles according to any of claims 1 to 10, wherein the functional groups of the matrix material are hydrophobic for use with a non-polar liquid phase.
13. Magnetic particles according to any preceding claim, wherein the matrix material further comprises an affinant for binding the target substance.
14. Magnetic particles according to any preceding claim, wherein the target substance is a nucleic acid.
15. Magnetic particles according to claim 13, wherein the affinant is capable of binding a cell, a protein, a virus or a prion.

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16. Magnetic particles according to claim 15, wherein the affinant comprises an antibody, a binding protein, a fragment of an antibody or binding protein, or a ligand.

17. Magnetic particles according to claim 16, wherein the affinant comprises a binding protein which comprises an avidin for binding to a target substance which is biotinylated, or the affinant comprises biotin and the target substance is avidinylated.

18. Magnetic particles according to claim 16, wherein the affinant comprises a ligand which comprises an oligonucleotide or a metal chelate specific for the target substance.

19. Magnetic particles according to any of claims 15 to 18, wherein the cell or protein is microbial.

20. Magnetic particles according to claim 13, wherein the target substance comprises a metal and the affinant comprises a chelator for the metal.

21. Magnetic particles according to claim 12, wherein the hydrophobic functional groups are capable of binding microorganisms or hydrophobic target substances.

22. A process for the preparation of magnetic particles capable of binding a target substance, which comprises providing an unmagnetised magnetic material, and providing a matrix material so as to form magnetic particles, wherein the magnetic material is remanent upon

exposure to a magnetic field and the matrix material has a surface comprising functional groups which promote disaggregation of the particles in the presence of a liquid phase.

23. A process according to claim 22, wherein the matrix material comprises a polymer.

24. A process according to claim 23, wherein the polymer comprises an organic polymer or a silica-based polymer.

25. A process according to any of claims 22 to 24, wherein the matrix material is provided preformed and added to the magnetic material.

26. A process according to claim 24, wherein the polymer is provided by polymerisation of a monomer in the presence of the unmagnetised magnetic material to form the magnetic particles comprising the magnetic material and a polymeric material.

27. A process according to claim 26, wherein the monomer comprises an organic monomer or a silica-based monomer.

28. A process according to claim 26 or claim 27, wherein the step of polymerisation comprises a step-growth condensation and/or a radical reaction.

29. A process according to any of claims 26 to 28, wherein the step of polymerisation takes place in an emulsion and the unmagnetised magnetic material is present in a discontinuous phase of the emulsion.

30. A process according to claim 29, wherein the step of polymerisation takes place in the discontinuous phase of the emulsion.

31. A process according to claim 29 or claim 30, wherein the monomer is present in a continuous phase of the emulsion, prior to polymerisation.

32. A process according to claim 31, wherein the monomer comprises an organic monomer and the emulsion is a water-in-oil emulsion.

33. A process according to claim 31, wherein the monomer comprises a silica-based monomer and the emulsion is an oil-in-water emulsion.

34. A process according to any of claims 26 to 28, wherein the step of polymerisation takes place in a solution.

35. A process according to any of claims 22 to 34, wherein the magnetic material comprises particles, the length or diameter of which is in the range 100 to 300nm.

36. A process according to any of claims 22 to 35, wherein the magnetic particles are as defined in any of claims 1 to 21.

37. Use of magnetic particles according to any of claims 1 to 21 or obtainable by a process according to any of

claims 22 to 36, for separating a target substance from a sample containing such a target substance.

38. Use of magnetic particles according to any of claims 1 to 13, or 15 to 19, for separating a target substance comprising a cell, a microorganism, or a protein from a sample containing such a target substance.

39. Use of magnetic particles according to any of claims 1 to 13, or 20, for separating a target substance comprising a metal from a sample containing such a target substance.

40. Use of magnetic particles according to any of claims 1 to 13, or 21, for separating a target substance comprising an organic compound from a sample containing such a target substance.

41. Use of magnetic particles according to any of claims 1 to 14, for separating a target substance comprising a nucleic acid from a sample containing such a target substance.

42. Use according to any of claims 37 to 41, wherein the target substance is isolated from the sample.

43. Use according to any of claims 37 to 41, wherein the target substance is depleted from the sample.

44. Use of magnetic particles according to any of claims 1 to 13, or 15 to 19, in a cell sorting apparatus.

45. A process for separating a target substance from a target substance containing sample, which comprises:

- (a) providing target substance binding magnetic particles which comprise a magnetic material and a matrix material, wherein the magnetic material is remnant upon exposure to a magnetic field;
- (b) providing a liquid phase comprising the target substance-containing sample;
- (c) dispersing the sample with the magnetic particles so as to bind the target substance thereto; and
- (d) isolating the particles from the sample by applying a magnetic field thereto and separating the particles from the liquid phase.

46. A process according to claim 45, wherein the step of dispersing the sample with the magnetic particles comprises subjecting the magnetic particles to disruption to disaggregate the particles.

47. A process according to claim 46, wherein the disruption comprises mechanical disruption selected from pipetting, stirring, vortexing and/or shaking, sonication or UV disruption.

48. A process according to any of claims 45 to 47, wherein the magnetic particles are as defined in any of claims 1 to 21, or obtainable by a process as defined in any of claims 22 to 36.

49. A process according to any of claims 45 to 48, wherein the magnetic particles are as defined in any of

claims 1 to 13, or 15 to 19, and the target substance comprises a cell, a microorganism, or a protein.

50. A process according to any of claims 45 to 48, wherein the magnetic particles are as detailed in any of claims 1 to 13, or 20, and the target substance comprises a metal.

51. A process according to any of claims 45 to 48, wherein the magnetic particles are as defined in any of claims 1 to 13, or 21, and the target substance comprises an organic compound.

52. A process according to any of claims 45 to 48, wherein the magnetic particles are as defined in any of claims 1 to 14, and the target substance comprises a nucleic acid.

53. A process according to claim 52, wherein the sample comprises unfractionated nucleic acid.

54. A process according to any of claims 45 to 53, wherein the target substance is isolated from the sample.

55. A process according to any of claims 45 to 53, wherein the target substance is a contaminant which is depleted from the sample.